THE FRAMEWORK OF EVERYTHING (FOE)

The Laws of Existence and the Structure of Our Universe

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ABSTRACT

This article introduces the Laws of Existence, a **framework** that provides a mathematical definition of what it means to exist, along with the associated laws and geometric constraints. Using this framework, alongside key scientific observations such as quantum tunneling, superposition, and gravitational waves, a novel geometric **structure** of the universe is proposed, which differs significantly from that of spacetime. Based on the proposed structure, a **theory** is derived to replace that of General Relativity (GTR). The resulting theory reconciles observations from both GTR and Quantum Mechanics (QM) without contradicting Bell's Theorem, while adhering to the principles of classical logic. The theory is further analyzed in the context of the Michelson-Morley Experiment (MME) and ultimately proposes a model for quantum gravity.

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1. INTRODUCTION AND INTENT

This research is a continuation of "The Laws of Existence and the Structure of our Universe" by Russell R. Smith, and multiple revisions under the current title. As the initial development progressed, it became evident that the underlying principles were far more expansive than originally conceived. The discoveries necessitated a broader title to fully comprehend the implications of the framework.

Mathematics is developed from mathematical logic, which is grounded in classical logic. Therefore, if a theory in physics, built upon mathematics, contradicts classical logic, it is inherently based on two conflicting sets of axioms, rendering it incoherent. Hence, all such theories inherently suffer from the following contradiction:

$$[classical\ logic \rightarrow Math \rightarrow Theory \rightarrow \neg Classical\ logic] \rightarrow \bot$$

To avoid such contradictions, any theory in physics that relies on mathematics must remain consistent with the axioms of mathematics, which are themselves derived from classical logic. This provides a straightforward method to dismiss theories in physics that defy logical coherence, irrespective of their predictive success. Physicists sometimes dismiss logic as metaphysical or unscientific, overlooking the fact that logic underpins their mathematics.

With that said, it is posited herein that everything that exists adheres to classical logic. Consequently, even if parallel universes exist with different laws of physics, they all conform to the same logical rules established in this framework. In other words, logic serves as the backbone that underlies all existence. Therefore, any valid theory of physics must be consistent with this framework. To explain, let $\Gamma = \{Laws\ of\ classical\ logic,\ and\ mathematics\}$. The framework depicted herein uses the laws of classical logic and mathematics to establish the laws of existence. That is $\Gamma \vdash \{The\ Laws\ of\ Existence\}$. A theory regarding the structure of our universe is then developed based on {The Laws of Existence}, and the set of scientific truths $\beta = \{$***Bell's Theorem, gravitational lensing, gravitational time dilation, Lorentz time dilation, invariance in the measurement of c, cosmic expansion, gravitational waves, quantization, superposition, entanglement, tunneling, wave-particle duality, and uncertainty***$\}$. That is $[\{The\ Laws\ of\ Existence\} \land \beta] \vdash \{Theory\}$, thus this theory is scientifically accurate and logically sound.

Physics frequently adopts a "top-down" approach, prioritizing successful predictions over intuitive explanations. This method is respectfully likened to attempting to solve the system $\{x + y = 1, 2x + \pi = ey\}$, by guessing values for x and y, rather than simply solving it algebraically. Each guess represents a new theory of physics, which can approach the correct values but may never produce a perfect result. When a theory is based purely on logic, even the processes involved in QM are simplified. Just as years of guessing can be quickly surpassed by solving the system algebraically, decades of research can be negated with a logical framework that makes the same predictions. The truthfulness of this analogy should become apparent throughout the text. This framework will fundamentally transform our understanding of physics by correcting existing errors and removing paradoxes.

To illustrate this “guessing” in physics, consider an object O with a measurable quantity (u), such as mass or charge. The true value of (u) is given by $Val(u) = M(u) + Err(u)$, where $M(u)$ is the measured value and $Err(u)$ represents the measurement error. Since every measurement includes some error, $|Val(u) - M(u)| = |Err(u)| > 0$. Now we can say that the speed of light is known to be constant, the laws of physics are invariant, or that point particles are known to exist, but this contradicts the fact that $|Err(u)| > 0$. Thus these are only assumptions. It should be clarified that any theory working within the confines of $Err(u)$ is therefore consistent with known physics.

Consider $\Gamma = \{3 + 4 = 9,\ 1 + 5 = 4\}$. In this case, $\Gamma \vdash (3 + 4 + 1 + 5 = 13)$, producing an accurate result but for the wrong reason. If we change Γ to $\{3 + 4 = 7,\ 1 + 5 = 6\}$, then $\Gamma \vdash (3 + 4 + 1 + 5 = 13)$ again yields the same result, but this time the derivation is logically sound. This analogy demonstrates that producing valid predictions alone is insufficient for a theory to be deemed reasonable. A theory must not only generate accurate predictions but also be grounded in logical truths. Altering logical truths effectively renders a theory nonsensical. Therefore, the fact that GTR and QM are testable and make valid predictions is insufficient for establishing a comprehensive theory of everything since their premises are not all true (as explained herein).

This article aims to establish a framework, termed the Laws of Existence, to evaluate the potential validity of any theory in physics. It also introduces a new theory that addresses and resolves all paradoxes associated with GTR or QM. Finally, the paper encourages researchers to consider this logical framework in their own research.

Lastly, imagine that you have two theories, X and Y, both predicting the same experimental outcomes. Theory X deviates from logical principles, has perplexed scientists for decades, and harbors over 30 paradoxes. In contrast, theory Y adheres to all logical truths, is easy to understand, and has no paradoxes. Which one would you choose?

2. DEFINITIONS

These definitions are philosophically based, allowing for a purely conceptual understanding. Building on these foundations, equations are introduced in the following sections to refine these concepts, making them scientifically rigorous.

Classical logic is a formal system for reasoning that deals with propositions (true/false statements), logical operators (AND, OR, NOT, etc.), mathematics, and truth tables. It allows for constructing valid deductive arguments where the conclusion necessarily follows from true premises. It does not include multivalued, fuzzy, or quantum logic.

A **property** is an intrinsic, non-trivial attribute of an entity independent of subjective perception or geometrical characteristics (i.e a square has the property of being square but that is a geometrical characteristic and thus does not satisfy the specific definition. Likewise, an imagined entity can have the property of change within the mind, but this is subjective and thus also does not satisfy the intended definition.).

Existence refers to the state or condition of possessing at least one property that distinguishes an entity from non-existence. It implies the actuality or reality of an entity, independent of subjective perception or mental constructs (in this context, epistemological existence is ignored). The word existence, or **existences**, is used to reference an entity that possesses a property and thus also therefore exists.

An **entity** is an object or concept that is independent of subjective perception or mental constructs that either exist or they don't. Entities can possess properties that contribute to their existence and define their identity (i.e an imagined sphere is an entity, but it does not possess a property, thus it cannot exist. An electron can exist because it has a property of charge.).

Property density is the quantified magnitude of a property possessed by an entity divided by the entity's length, area, or volume as specified by the context.

Binding Property is any property that binds an existing entity together. A binding property, like all properties, must have an internal flux.

Flux is the measure of how much of a property of an entity passes through a boundary. It indicates the flow, transfer, or influence of the property across or through the specified area or region, regardless of whether the property physically moves or not.

A **transition** involves altering an entity's property or spatial extent.

A **volumetric** geometry occupies empty space and excludes regions that are strictly a point, area, or length (i.e Two spheres connected by a line is not a volumetric geometry, whereas the two spheres sharing some volume is.).

Space is the expanse that contains the universe's matter and energy, in addition to the matter and energy itself. If dimensionality is defined beyond the universe, space includes that as well. **Empty Space** references the same but without the presence of any existence.

To **constrain** means to impose limits or conditions.

Information is a quantifiable and interpretable representation of the state or properties of a system, whether physical or logical.

Causality is the principle that specifies a cause-effect relationship between events such that the state of a system at one point determines its state at another point, consistent with the governing laws of the system.

3. FOUNDATIONAL PRINCIPLES

3.1 The Dirac delta function and point particles

Loose Definition: Consider the Dirac delta function $\delta(x - \alpha)$ loosely defined as [2]:

$$\delta(x - \alpha) \equiv 0 \text{ when } x \neq \alpha$$

$$\delta(x - \alpha) = \infty \text{ when } x = \alpha$$

$$\int_{\alpha^-}^{\alpha^+} \delta(x - \alpha)dx = 1$$

In this case the width of the spike is identically $\Delta x \equiv 0$, thus the geometry of the spike is that of a line segment. By definition, a line is a 1-d geometry and thus it cannot be 2-d geometry. It follows that the area of the spike is by definition zero. Thus:

$$[\int_{\alpha^-}^{\alpha^+} \delta(x - \alpha)dx = 1] \wedge [\delta(x - \alpha) \equiv 0\, when\, x \neq \alpha] \rightarrow \perp$$

Notice that these are just basic principles of geometry, and that simply defining the delta function to have certain properties does not make it logically possible. With that said, the delta function takes advantage of the indeterminate form $0 \cdot \infty = A$ to produce confusion, in the same manner that writing the area of a line as $0 \cdot \infty = A$ produces confusion. However, in reality the area of a line is always zero. Thus this definition of the delta function is nonsensical.

It should be pointed out that this concept of the delta function can be aligned with reality by allowing the spike to have a non-zero width and a finite height. In this case, all three properties are logically compatible but then it's easy to see that it doesn't apply to point particles.

Formal Definition: Now the main purpose of the delta function is to sift out the value of a function at a point, so its formal definition is just that $\delta(x - \alpha)$ satisfies the property [2]:

$$\int_{-\infty}^{\infty} \delta(x - \alpha)f(x)dx = f(\alpha)$$

In this case, the delta function is a distribution that picks out specific value(s) of $f(x)$ such that the property holds. Now, typically we don't care specifically what the shape of the distribution is, but in this case it is necessary to analyze it. Notice that if the delta function is non-zero only at specific points, then at each point the delta function reduces to the first definition. That is, if $\delta(x - \alpha) = 0$ accept at $x = \{\alpha_1, \alpha_2, ...\}$, then:

$$\int_{-\infty}^{\infty} \delta(x - \alpha)f(x)dx = \int_{\alpha_1^-}^{\alpha_1^+}[\delta(x - \alpha_1)f(x)]dx + \int_{\alpha_2^-}^{\alpha_2^+}[\delta(x - \alpha_2)f(x)]dx...$$

$$= f(\alpha_1)\int_{\alpha_1^-}^{\alpha_1^+} \delta(x - \alpha_1)dx + f(\alpha_2)\int_{\alpha_2^-}^{\alpha_2^+} \delta(x - \alpha_2)dx$$

$$= f(\alpha_1) \cdot 0 + f(\alpha_2) \cdot 0$$

$$= 0$$

Likewise, if $f(x) = 0$ accept at $x = \{\alpha_1, \alpha_2, ...\}$, then the same result occurs. Thus $\exists\, D \subset D_\delta \cap D_f$ $|\, D$ is continuous and $\delta(x - \alpha)$ and $f(x)$ are non-zero. This eliminates the entire purpose of the delta function in relation to point-particles.

Let's elaborate: Consider a particle that has some field $f(x)$. In order to be measured, that field must first exist. Therefore by using $f(x)$ with the delta function, one would not be modeling a point particle, but would be modeling the existence of the field as if it were a point-particle. It follows that for a point particle, $D_f = \{\alpha_1\}$, thus $\int_{-\infty}^{\infty} \delta(x - \alpha)f(x)dx = 0.$

With that said, it is important to clarify why the delta function still produces valid results in physics. Consider the Gaussian distribution $G(x, \beta) = |\beta|e^{-(x\beta)^2}/\sqrt{\pi}$, where over the real number line $\int_{-\infty}^{\infty} |\beta|e^{-(x\beta)^2}/\sqrt{\pi}dx = 1\ \forall\ 0 < |\beta| < \infty$ [3]. By l'hopital's Rule, $\forall\ x \neq 0$ $\lim_{\beta \to \infty} |\beta|e^{-(x\beta)^2} = \lim_{\beta \to \infty} 1/(2\beta x^2 e^{(x\beta)^2}) = 0$. Thus $G(x \neq 0, \beta \to \infty) = 0$. At the point $x = 0$, $G(0, \beta) = |\beta|e^{-(0\beta)^2}/\sqrt{\pi} = |\beta|/\sqrt{\pi}$, and thus $G(0, \beta \to \infty) = \lim_{\beta \to \infty} |\beta|$. Therefore:

$$G(x \neq 0, \beta \to \infty) = 0$$
$$G(0, \beta \to \infty) \to \infty$$

That is, $G(x, \beta \to \infty)$ models the first two conditions in the first definition of the delta function, but since $\int_{-\infty}^{\infty} G(x, \beta \to \infty)dx = 0$, it cannot simultaneously satisfy the third condition. However, if $|\beta| < \infty$, then $\int_{-\infty}^{\infty} G(x, |\beta| < \infty)dx = \int_{-\infty}^{\infty} \delta(x)dx = 1$, thus the delta function produces the correct value by assuming non-point particles to have the geometry of a point.

3.2 Key assumptions

The following are assumed true in developing this work:

Classical logic [4]:

1. Law of Identity ($A \equiv A$)
2. The law of Non-Contradiction ($\neg(p \land \neg p)$).
3. The Transitive law ($(A \to B) \land (B \to C) \to (A \to C)$)
4. The law of Excluded Middle ($(p \lor \neg p)$)
5. The law of Contraposition ($(p \to q) \leftrightarrow (\neg q \to \neg p)$)
6. De Morgan's laws ($\neg(p \land q) \leftrightarrow \neg p \lor \neg q$ and $\neg(p \lor q) \leftrightarrow \neg p \land \neg q$)

Applied Mathematics:

1. Local Homeomorphism Theorem.
2. Whitney Embedding Theorem [5].
3. The principles and methodologies of general mathematics, particularly calculus, differential geometry, real analysis, and calculus of variations.
4. The Finite Precision Theorem (Infinite precision is not obtainable on a continuous spectrum).

The following scientifically verified experimental results and observations:

Gravitational lensing, gravitational time dilation, Lorentz time dilation, invariance in the measurement of c, cosmic expansion, gravitational waves, quantization, superposition, entanglement, tunneling, wave-particle duality, uncertainty

4. FRAMEWORK - THE LAWS OF EXISTENCE

To develop a robust theory of everything, it is imperative to derive a logical framework that defines the boundaries of all possibilities and then restrict the framework using scientific observations to align it with the physics of our universe. As a result, some deductions made herein may initially seem at odds with existing scientific findings. However, when integrated into the broader theoretical context, they align with empirical observations.

4.1 The general concept of existence

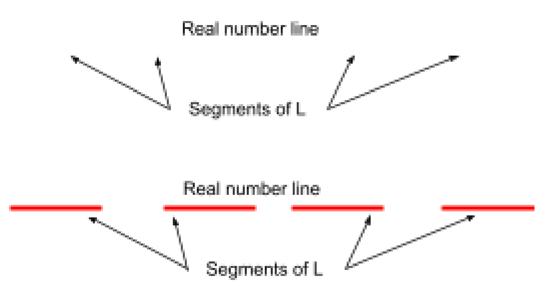


Fig 1 represents the distinction between an entity having a property, and thus existing; and an entity not having a property, and therefore not existing. At the top, an entity does not have a property that allows it to be distinguished from the real number line and thus this represents an entity that does not exist. At the bottom is an entity that is divided into k equal parts, in which each part has the property of being red that allows it to be distinguished from the real number line.

While mathematical objects do not exist (ontologically), the following acts as a concept for deducing what it means to exist. Let L denote the line segment [0,1] on the real-number line $\mathbb{R}$. Dividing L by a positive natural number k yields k individual, equal-length line segments. At the top of **Fig 1**, each line segment has a length of L/k but initially lacks any distinguishing property that sets it apart from the continuum of $\mathbb{R}$ itself (thus it is represented as being invisible). Below this representation, the same number line is depicted with segments of L colored red. This red coloring serves as a distinguishing property that defines the existence of these segments relative to the number line. As established by the following theorems, existence necessitates a type of geometry (like the length of the line segment), in conjunction with a property (like those associated with appearing red) that distinguishes it from that which doesn't exist. Just as L can be divided into smaller segments, an existence can also be divided into smaller parts unless there is a specific constraint that prevents such division. The following theorems establish the laws of existence.

4.2 The Laws of Existence

Define the following for an entity Z:
$P(Z)$: The entity Z has a property.
$S(Z)$: Z has the property of self-causation, suggesting Z can cause its own existence.
$C(Z)$: Z has the property of constraining.
$E(Z)$: The existence of Z can arise from non-existence.
$B(Z)$: Z began to exist indicating a transition into existence.
$O(Z)$: Z was formed from at least one already existing entity.
$I(Z)$: Z possesses the property of having information.

4.2.1 Properties

By the definition of existence, if Z exists then it has a property, and if Z has a property, then it exists. Thus:

$$[Def.\ of\ Existence] \rightarrow [P(Z) \leftrightarrow Z]$$

4.2.2 Self-Causation

By the definition of S(Z), $S(Z) \rightarrow P(Z)$; and by the Definition of Existence, $P(Z) \rightarrow Z$. Thus, by the transitive law $S(Z) \rightarrow Z$, and by its contrapositive $\neg Z \rightarrow \neg S(Z)$. Thus, if Z doesn't exist, it cannot cause itself to exist. Thus:

$$\neg S(Z) \quad \text{(Self Causation Negation)}$$

Therefore, Z cannot be self-causing. To clarify, if two pre-existing entities combine to form Z, it is the interaction between these two entities that results in the formation of Z, rather than Z causing its own existence.

4.2.3 Constraint

By the definition of C(Z), $C(Z) \rightarrow P(Z)$. Combined with the Definition of Existence, the antecedent of the transitive law is $[C(Z) \rightarrow P(Z)] \land [P(Z) \rightarrow Z]$. Thus:

$$C(Z) \rightarrow Z \quad \text{(Constraint Law)}$$

Thus, for Z to be constrained, Z must first exist. By the contrapositive of the Constraint Law, if Z does not exist, it cannot be constrained to begin existing (from non-existence). It should be clarified that the converse of the Constraint Law is not necessarily true. That is:

$$\Diamond(Z \nrightarrow C(Z)) \quad \text{(Non-Biconditional Constraint Law)}$$

Thus it is possible that two entities exist that cannot constrain each other, and are thus able to occupy the same spatial coordinates. It should be noted that the Non-Biconditional Constraint Law is used as a reference for clarity, not as part of the logical argument, and thus the introduction of the diamond operator should be appropriate.

4.2.4 Continuity

By the Self Causation Negation, Z cannot cause itself to exist; and by the contrapositive of the Constraint Law, Z cannot be constrained to exist (out of non-existence). That is $\neg S(Z) \wedge [\neg Z \rightarrow \neg C(Z)] \rightarrow \neg E(Z)$, thus:

$$\neg E(Z) \quad \text{(Law of Ontological Continuity)}$$

Therefore, Z cannot be produced from non-existence. This implies that if Z began to exist, it must have formed from pre-existing entities. Conversely, if Z was formed from such entities, then Z transitioned into existence. Thus:

$$B(Z) \leftrightarrow O(Z) \quad \text{(Existence Law)}$$

4.2.5 Information

By definition, if Z possesses information, then Z exists. That is:

$$I(Z) \rightarrow Z \quad \text{(Information law)}$$

Thus, information can only be transferred from one existing entity to another through/by an existing entity (Since a field has information, the field exists, hence why the delta function doesn't model a point-particle but instead models a field as a point-particle.).

4.2.6 Time

According to the Information Law, time can only be conveyed through the presence of an existence. In the absence of an existence, there would be nothing to measure with a clock or to move through the dimension of time, rendering the concept of time as undefined. Thus:

$$Time \rightarrow Existence \quad \text{(Time-Existence Relation)}$$

With this foundation established, it is essential to define existence from a geometric perspective. It is widely accepted, though not assumed within this context, that existence occupies space. However, the question remains: can existence manifest as a point, line, or area? Is existence compressible, or is it divisible? The following discussion seeks to address these inquiries, beginning with the Point Entity Theorem.

4.2.7 Point Entity Theorem

Statement: A point entity can't exist.

Proof: Let Z be a point entity. Define the following:

$V(Z)$: Length, area, or volume of Z.
$\rho(Z)$: Corresponding (to $V(Z)$) average linear, area, or volume property density of Z.
$Point(Z)$: Denotes that Z is a point entity.

1. Z being a point entity implies that $V(Z)$ is identically zero, and that $\rho(Z)$ is undefined exterior to it.
$$Point(Z) \rightarrow V(Z) \equiv 0$$
2. The volume of Z being identically zero implies that the product of the volume and the property density is also identically zero.
$$1. \rightarrow \rho(Z)V(Z) \equiv 0$$
3. The product of the volume and the property density being identically zero, implies that Z doesn't have a property.
$$\rho(Z)V(Z) \equiv 0 \rightarrow \neg P(Z)$$
4. Without a property, by the definition of existence, Z cannot exist.
$$\neg P(Z) \wedge [Def.\ of\ Existence] \rightarrow \neg Z$$

QED

<u>Considerations regarding the Point Entity Theorem:</u> As shown above, the Dirac Delta function cannot recover properties of a point particle. In quantum mechanics, fundamental particles are often considered point-like, and high energy experimentation affirms that no (currently) detectable structure exists [1]. However, the Point Entity Theorem shows that such particles cannot exist. This conflict between classical logic and observation will be addressed later in the article. With that clarified, it is necessary to derive a metric for space that can then be used to define the geometries of entities that exist within it. This leads to the Isomorphism Theorem of Space.

4.2.8 Isomorphism Theorem of Space (ITS)

Statement: In the context where points in space are represented as vectors, empty space is isomorphic to the vector space $(\mathbb{R}^n, \mathbb{R}, +, \cdot)$ for some $n \geq 3$, where $\mathbb{R}^n$ denotes an n-dimensional Euclidean space over the field of real numbers $\mathbb{R}$, and + and · denote vector addition and scalar multiplication, respectively.

Proof: Let S represent points in space, and $\mathbb{R}^n$ be the n-dimensional Euclidean space for some $n \geq 3$. Define $\phi: \mathbb{R}^n \rightarrow S$ by $\phi(< v >) = (v)$, where each vector $< v > \in \mathbb{R}^n$ is mapped to a corresponding point $(v) \in S$.

By the Local Homeomorphism Theorem, for any manifold M of dimension m, any point (v_{origin}) locally resembles $\mathbb{R}^m$. Therefore it is established that for M, representing the geometry of space, $(v_{origin}) = (0, 0, 0...) \in S$, and $< 0, 0, 0... > \in \mathbb{R}^n$, and thus at least one point in S corresponds to a vector in $\mathbb{R}^n$.

By the Law of Excluded Middle, existence either exists at (v), or it doesn't. If existence exists at (v), then (v) must first be well-defined. If existence doesn't exist at (v), then by the contrapositive of the Constraint Law, nothing exists at (v) to prevent existence from existing at (v). Therefore, $\forall < v > \in \mathbb{R}^n$, (v) is well-defined.

Let $< v_1 >, < v_2 > \in \mathbb{R}^n$:

1. **Injective:** Suppose that $\phi(< v_1 >) = \phi(< v_2 >)$. It follows that $(v_1) = (v_2)$, and thus $< v_1 > = < v_2 >$. Therefore ϕ is injective.
2. **Surjective:** For any point $(v_i) \in S \; \exists \; \phi^{-1}(v_i) = < v_i > \in \mathbb{R}^n$. Thus ϕ is also surjective.
3. **Linear:** $\phi(< v_1 + v_2 >) = (v_1 + v_2) = \phi(< v_1 >) + \phi(< v_2 >)$, and $\phi(c < v_1 >) = c(v_1) = c\phi(< v_1 >)$ and thus ϕ preserves vector addition and scalar multiplication.

Since ϕ is bijective and preserves vector operations, it is an isomorphism between $\mathbb{R}^n$ and S.
QED

Considerations regarding the ITS: According to the Isomorphism Theorem of Space, space is smooth, continuous, and infinite in all its defined dimensions, with a Euclidean metric. Every point in space either contains existence or nothing exists there to prevent existence from existing there. Thus, space itself cannot be quantized or discrete. Therefore, for any manifold M representing the real structure of the universe, each point on M can be described as a point in $\mathbb{R}^n$ for some $n \geq 3$. This is very similar to the Whitney Embedding Theorem (WET) stating that a smooth manifold of dimension n/2 can be embedded into $\mathbb{R}^n$ [5], but the WET doesn't guarantee that there will not be deformations whereas the ITS does (for space).

For the structure of the universe (represented by M) to deform in response to mass and energy, by the Constraint Law, it must first exist. In the framework of general relativity, this implies that spacetime itself is a tangible physical entity capable of interacting with matter and energy. Furthermore, since M is not isomorphic to $\mathbb{R}^n$, the universe must exist within infinite nothingness (S). This does not suggest that there is nothing else beyond the universe; rather, it signifies that space is infinite, and everything that exists does so within this boundless expanse.

Now that a metric has been defined for space, it can be used to represent additional geometries of any entity existing within space. This leads to the following theorem.

4.2.9 1-D Entity Theorem

Statement: A 1-dimensional entity cannot exist.

Proof: Let Z be a 1-dimensional entity in space.

1. Let x be a point on Z such that x is not an endpoint:
$$x \in Z \wedge x \notin endpoints(Z)$$
2. By the Isomorphism Theorem of Space, each point x on Z is well-defined:
$$[ITS] \rightarrow \forall x \in Z, \textit{well-defined(x)}$$
3. Since x is not an endpoint, x divides Z:
$$1. \rightarrow x\ divides\ Z$$
4. Since x divides Z, and x is a point, flux does not pass through x.
$$3. \wedge Point(x) \rightarrow \neg flux\ through(x)$$
5. Without flux, there isn't a binding property holding Z together at x.
$$4. \rightarrow \neg(binding\ property(x))$$
6. Since x is arbitrary, this applies to all internal points on Z:
$$5. \wedge x\ is\ arbitrary \rightarrow \forall x \in Z, \neg(binding\ property(x))$$
7. Without a binding property, Z cannot exist:
$$6. \rightarrow \neg Z$$

Since each point x on Z divides Z, and x is a point entity, flux cannot pass through x to bind Z together. Therefore, Z lacks any property that could bind its segments together. Consequently, Z cannot exist.

As a clarification, suppose that the flux of Z goes around the point x, to bind Z together. In this case, such flux is either 1 dimensional and thus bound by this theorem, or such flux is higher dimensional in which the following theorems apply.
QED

Considerations regarding the 1-D Entity Theorem: In string theory, a string is theorized as a one-dimensional entity propagating in spacetime. These strings are hypothesized to be the fundamental constituents of the universe, replacing point-like particles of the Standard Model [1]. However, even if you consider a string as collectively being fundamental, by the 1-D Entity Theorem, there isn't a means for such entities to possess a property, and thus they do not exist. This is independent of the number of dimensions, presumably 10 or 11, in which the string would propagate. This leads to the following Theorem:

4.2.10 2-D Entity Theorem

Statement: A 2-dimensional entity cannot exist.

Proof: Let Z be a 2-dimensional entity in space.

1. Let x be a 1-d entity on Z such that x divides Z into two sections:
$$x\ divides\ Z$$
2. By the Isomorphism Theorem of Space, each point y on Z is well-defined:
$$[ITS] \rightarrow \forall y \in Z, \textit{well-defined}(y)$$
3. Since x divides Z, and x is 1-d, flux does not pass through x.
$$1. \wedge\ [x\ is\ 1d] \rightarrow \neg flux\ through(x)$$
4. Without flux, there isn't a binding property holding Z together at x.
$$3. \rightarrow \neg(binding\ property(x))$$
5. Since x is arbitrary, this applies to all 1-d entities on Z:
$$4. \wedge\ x\ is\ arbitrary \rightarrow \forall x \in Z,\ \neg(binding\ property(x))$$
6. Without a binding property, Z cannot exist:
$$5. \rightarrow \neg Z$$

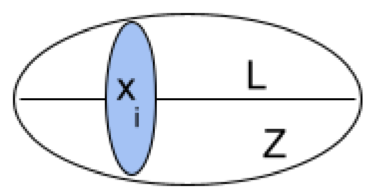
QED

Considerations regarding the 2-D Entity Theorem: In the context of M-Theory, a 0-brane, 1-brane, and 2-brane cannot exist. This leads us to the 3-D Entity Theorem.

4.2.11 3-D Entity Theorem

Statement: A 3-D entity can exist.

Fig 2 represents a 3-d entity Z, with the longest possible line segment L positioned inside such that both ends of L are on L. The cross-section x_i is perpendicular to L, and divides Z.



Proof: To establish the existence of a 3-d entity, it is necessary to first demonstrate that the same logic preventing the existence of lower-dimensional entities does not prevent the existence of a 3-d entity. Define the following in relation to the **Fig 2**:

Z: A 3-d entity.
L: The longest possible line segment through Z.
|L|: The length of L.
x_i: A cross-section of Z perpendicular to L.

1. By the 2-D Entity Theorem, x_i does not exist (DNE).
$$[2\text{-}D\ Entity\ Theorem] \rightarrow \forall x_i \in Z,\ DNE(x_i)$$
2. By the Constraint Law, x_i cannot prevent flux from passing through it.
$$[Constraint\ Law]\ \wedge\ DNE(x_i) \rightarrow \neg Prevent\ Flux(x_i)$$

3. x_i has an area, x_i cannot prevent flux from passing through it, thus a binding property can passes through x_i.

$$Area(x_i) \wedge 2. \rightarrow Z\ can\ have\ binding\ property(x_i)$$

4. Since x_i is arbitrary, this applies for all $x_i \in Z$.

$$3. \wedge\ x_i\ is\ arbitrary \rightarrow \forall x_i \in Z, Z\ can\ have\ binding\ property(x_i)$$

Therefore, the same logic that prevents a 1-d, or 2-d entity from existing, doesn't apply to a 3-d entity.

It is necessary to establish that, although a 3-dimensional entity can be considered a set of point, line, or area entities that do not individually exist, this does not prevent the existence of the 3-dimensional entity itself. That is. $\forall x_i \in Z,\ x_i$ does not exist, yet Z can exist. To prove this, consider y: $[0, \infty] \rightarrow [0, |L|]$, defined as $y(x_i) = |L|/(1 + x_i)$. For each x_i, the thickness is zero, but the total length of Z is $|L| > 0$. Therefore, by tying the property of Z to the thickness of x_i, such that $\rho_i = \beta x_i$ for some $\beta \neq 0$, a property of Z can be recovered with |L|. That is $\int_0^{|L|} \rho(Z) x_i d|L| = \int_0^{|L|} \beta x_i^2 d|L| \neq 0$. Therefore, a 3-D entity can exist, even though the individual points, lengths and areas comprising it do not exist.
QED

4.2.12 Missing Geometry Theorem

By the Point, 1-D, and 2-D entity theorems, if an entity has a geometry in which any portion is not volumetric, that portion does not exist. Consequently, enclosing an existing entity within a larger entity does not confer existence to the larger entity. Therefore, if two entities are not connected volumetrically, or such volume doesn't have a property, the two entities exist independently.

4.2.13 Mathematical Definition of Existence

The aforementioned theorems establish the criteria for an entity Z to exist. Such criteria can be explicitly defined using the following sets:

$$G = \{g | g\ is\ volumetric\}$$
$$P = \{p | p\ is\ a\ property\}$$

In which the existence of Z is established as:

$$Z = (g, p) \quad \text{(Mathematical definition of existence)}$$

Therefore, the set ξ comprising the entirety of everything that exists is defined as:

$$\xi = \{Z\} \quad \text{(Set of everything that exists)}$$

This formulation encapsulates the idea that an existing entity Z is characterized by a volumetric geometry g, and at least one property p. By the law of Excluded Middle, anything that doesn't satisfy the definition of existence does not exist. Therefore, the set N of everything that does not exist is defined below. It should be clarified that neither N nor ξ exist, and thus to avoid Russell's Paradox, they are excluded from N. That is:

$$N = \{Y \mid g \notin G \ \vee \ p \notin P\} \backslash N, \xi \quad \text{(Set of everything that doesn't exist)}$$

It follows that an entity that has spatial extent but lacks a property belongs to N. Therefore space, despite its spatial nature, does not exist. That is:

$$Space \in N$$

This makes sense intuitively because an existence can move without constraint within empty space. By definition, everything that exists, exists in infinite space. That is:

$$\forall Z \in \xi,\ Z \ exists \ in \ infinite \ space \quad \text{(Law of Spatial Existence)}$$

Now that the geometry g for existence is established, this leads to the following theorem regarding the potential for infinite divisibility.

4.2.14 Existence Divisibility Theorem

Statement: Any existing entity can be infinitely divided into multiple existing entities, provided that a property doesn't prevent such division.

Proof: Let Z be an existing entity. By to the Finite Precision Theorem, any process external to Z cannot divide or compress Z with perfect precision so as to produce $Z_i \subset Z \mid Z_i$ has the geometry of a point, line, or area. Thus, $\forall Z_i \subset Z$, the volume $V(Z_i) > 0$. Therefore, let L_i be the longest possible line segment such that both endpoints are positioned on Z_i. Since Z_i has a non-zero volume, the length of L_i, denoted $|L_i|$, is greater than zero ($|L_i| > 0$). Now suppose that Z_i is divided into k equal-length segments sliced perpendicular to L_i such that $|L_i| = k(\frac{|L_i|}{k})$ for some $k \in \mathbb{N}$. If for some k, $\frac{|L_i|}{k} = 0$, then $|L_i| = 0k$ contradicting the premise that $|L_i| > 0$. It follows by contradiction that, $\frac{|L_i|}{k} > 0 \ \forall \ k$, and thus Z is infinitely divisible unless a property prevents it.

Consider the case in which Z divides itself. In this scenario, each point, line, or area would repel every other point, line, or area on Z, potentially reducing Z to a set of points, lines, or areas. By the previous theorems, such points, lines, or areas do not exist independently, and thus this scenario is not possible.

Therefore, whether an external process removes a section of Z, divides Z into infinitely many sub-entities, or Z divides itself internally, a subset of Z will never be reduced to zero volume. Thus, Z can be infinitely divided into multiple entities, provided that a property does not prevent it.
QED

4.2.15 The total existence in space

It follows from the Existence Divisibility Theorem that if Z exists, a subset of Z cannot be reduced to non-existence; and according to the Law of Ontological Continuity, Z cannot be produced from non-existence. Therefore, although Z may be added to another existing entity, divided into multiple entities, or permuted, the total existence in space remains constant. Thus:

$$The\ total\ existence\ |\xi|\ in\ space\ is\ constant\ and\ has\ [always]\ existed$$

4.2.16 Existences occupying the same space

By the Non-Biconditional Constraint Law, existence doesn't imply constrainability. Therefore, if two existences do not have properties that interact, then nothing prevents them from occupying the same spatial coordinates. It should be clarified that even if the properties interact, it is not necessarily true that they cannot occupy the same space, and nothing states that two such entities actually exist.

A specific example should be considered for clarity: Let Z_1 and Z_2 exist, and let ρ_1 and ρ_2 be the respective property densities throughout such that $\rho_1 =- \rho_2$. Therefore, if for some volume element V, Z_1 occupies the same spatial coordinates as Z_2, then the property value within V is $V(\rho_1 + \rho_2) = V(\rho_1 - \rho_1) = 0$ which initially might seem to contradict the claim that the total existence $|\xi| = const$. However, just like two opposing forces canceling doesn't imply that such forces are not being applied, two entities with opposing properties that cancel doesn't imply that the entities FEase to exist.

4.2.17 The propagation of information

Consider two existences, Z_1 and Z_2, in an otherwise empty space, separated by a distance $\varepsilon > 0$. By the contrapositive of the Information Law ($\neg Z \rightarrow \neg I(Z)$), regardless of how small ε is made, neither entity can have any information about the other unless an existence is transferred (or shared) between them. Thus, suppose that existence γ is transferred from Z_1 to Z_2. Consequently, Z_2 can have information about Z_1, but Z_1 cannot have information about Z_2.

4.2.18 States of existence and interactions

Assume that the total existence of Z is fixed, and that Z takes the form of a rod. According to the Existence Divisibility Theorem, each point on Z can be sheared, allowing Z to deform and "vibrate" like elements of String Theory. Now, suppose Z exists in the S_z^i state. Since Z is assumed to be vibrating, there is some other state S_z^{i-1} in which Z has existed. If Z were to become non-existent temporarily between the states of S_z^{i-1} and S_z^i, then by the Law of Ontological Continuity, Z could not begin existing again contradicting the premise. Therefore, the state function S_z of Z is continuous, and can thus be expressed as $S_z = S_z(\chi)$ for some parameter χ. Since Z is presumably not produced from another existence, by the contrapositive of the Existence Law, Z did not have a beginning. Thus, the domain of $S_z(\chi)$ can be represented as the entirety of the real number line.

Since causality presumably always holds, $S_z(\chi)$ is necessarily a causal loop in which each state of Z causes the next. It follows that if two existences Z_1 and Z_2 interact, their interaction $\tilde{I}(Z_1, Z_2)$ results in a state that is determined by the applicable laws and the respective states during interaction so as to not violate causality.

4.2.19 Physical Laws and Free-Will

A physical law is information, and thus only an existence can have the property of a law. That is, a law is intrinsic to an existence. Therefore, suppose that Z has a law that determines each preceding state $S_z(\chi)$ such that causality is never violated: It follows that Z is deterministic. Now suppose that Z does not have an intrinsic law other than that which requires it to change states through its causal loop. In this case, Z is required to change states, but there isn't an intrinsic law that establishes which state Z must transition into. It follows that at each transition, Z has a choice introducing the notion of free-will. That is:

$$[Z\ is\ required\ to\ change\ states] \wedge [Z\ doesn't\ have\ a\ deterministic\ law] \rightarrow [Free\ will]$$

4.2.20 Spacetime, and the meaning of time

By the Constraint Law, in order for spacetime to be constrained to deform in the presence of mass and energy, spacetime must first exist. This is consistent with the Time-Existence Relation, necessitating that in order for time to be defined at each point in spacetime, each point must have an existence. By the mathematical definition of existence, spacetime must therefore have a geometry g and a property p. Spacetime is a 4-d manifold and thus it has a hyper-volumetric geometry g, and since each point in spacetime is represented by the coordinates (x_0, y_0, z_0, t_0) a property is necessarily that of time. That is, at each point in spacetime, time must be defined. By the Isomorphism Theorem of Space, spacetime exists in infinite space that is isomorphic to $\mathbb{R}^n$ for some integer $n \geq 3$. Since spacetime is not isomorphic to $\mathbb{R}^n$, there is infinite space beyond the bounds of spacetime producing problems related to Olber's Paradox. Now this paper doesn't argue in favor of spacetime so these are just requirements for those in support of it.

By the Isomorphism Theorem of Space, space is isomorphic to $\mathbb{R}^n$ for some integer $n \geq 3$, and by the contrapositive of the Constraint Law, nothing exists in empty space to constrain an existence from freely moving. Therefore, an existence Z existing in open space is free to move indefinitely in all defined dimensions without the need for a temporal one. That is, since Z exists, it automatically has the ability for change that we associate with the concept of time. Therefore:

The ability for change is a property of existence

Assuming spacetime, everything within our observable universe moves through the temporal dimension. Consequently, there must be a mechanism within spacetime that ensures uniform movement through time. It is not entirely clear if advocates of spacetime have a definitive understanding of what this mechanism is. In the proposed model, there is a similar mechanism referred to as the FE, but rather than ensuring everything moves through time uniformly, such a mechanism ensures that the distances traveled by each existence within the observable universe are linked together. That is, rather than dealing with time, we deal with distances.

To explain this, consider two existences Z_1 and Z_2 moving towards a third existence Z_3 in otherwise empty space. Time doesn't exist, so the only way to relate the 3 existences is through the concept of distances. Therefore, we can say that the distances that Z_1 and Z_2 move respectively (relative to Z_3) are d_1 and d_2, and they are related by some equation such as $d_1 = 4d_2$. In the context of time, this means that d_1 is traveling 4x faster than d_2. Now, rather than directly relating d_1 to d_2, a fourth existence Z_4 can be introduced, and $d_4$can then be compared separately to d_1 and d_2. As an example, $d_4 = 12d_2$, and $d_4 = 3d_1$.

In this context, d_4 represents our concept of time. To explain this, imagine Z_4 as a photon, and d_4 is the distance that the photon moves between two events occurring. Since the distance d_4 is typically very large, we have invented devices called light clocks that allow us to instead measure the number of passes from mirror to mirror. If we now use the light clock to measure the "speed of light", the light in both the clock and the experiment change proportionally so the measurement is a geometry relation resulting in all reference frames measuring the same value. That is, the "speed" of light is measured as constant independent of it actually being constant, and the distance that light travels in one reference frame relative to another is interpreted as time dilation. Now one might argue that light requires time to propagate, but this is not true: Light propagates due to its causal loop $S_\gamma(\chi)$, and we measure time based on the distance that it travels.

This concept of time being a relationship between events, and the distance that light travels between them needs further clarification. Suppose that you have an atomic clock. In order for the existences making up the atom to function cohesively, by the Information Law, existences need to be exchanged between the components. Such existences represent the force carriers of the standard model. With that said, the same FE that causes the photon to move less distance in one area of space than another, also causes all force carriers to do essentially the same. Thus, the atomic clock time dilates like the light clock (even without the presence of a photon).

With that said, take a 3-d slice of spacetime. Now again, we are not advocating for spacetime so this is merely exemplary. Since that slice is volumetric, by the Missing Geometry

Theorem, in order for spacetime to exist that slice has to also exist. If we now say that everything that we observe in that slice is free to move independent of a temporal dimension, then there must exist a mechanism that ensures consistency throughout such that everything that we observe moves as if transitioning through time. That mechanism is the FE. To clarify, everything that we observe exists within the FE, and moves independent of a temporal dimension. The FE regulates how far each object in the universe moves in relation to others giving the illusion of moving through time. Since the FE exists, it can deform under the influence of mass and energy as objects move producing the results attributed to GTR. Thus, only the slice of spacetime would need to exist, implying that spacetime itself would simply be a plot of its worldlines.

Now, although the slice of spacetime is 3-d, it occupies a higher dimensional space. Since there isn't any indication that higher dimensional space is possible, we want to restrict the metric to that of Euclidean 3-space such that black holes, gravitational waves, etc still occur. We shall therefore loosely define the FE as being an existence, or set of existences, that can deform under the presence of mass and energy to produce the results of GTR, such that the FE is a subset of space isomorphic to $\mathbb{R}^3$.

Putting this all together, everything that we observe within the universe exists within the FE. Without the FE present, an existence Z transitions through its causal loop $S_z(\chi)$ freely moving indefinitely in any direction. With the FE present, the interactions $\tilde{I}(CE, Z)$ regulate the distance traveled by Z. Thus the FE merely regulates how far objects move within it relative to each other giving the illusion of time. As matter moves through the FE, the FE deforms producing the results attributed to GTR.

5. THE STRUCTURE OF THE UNIVERSE

It is necessary to establish a structure of the universe that is consistent with the Laws of Existence, and known scientific truths. Such a structure is established as follows.

Define the following:

FE(M): This is the universe's structure represented by the manifold M. Within the context of GTR, M serves as the spacetime manifold that models the universe, but M is not the universe itself. For the sake of completeness, if FE(M) is composed of distinct existences that perhaps interact like a lattice, then by the Missing Geometry Theorem, FE(M) references those distinct existences.

Deform(FE): FE(M) is constrained to deform by the presence of mass and energy.

Exists(FE): FE(M) exists.

FE_AE: FE(M) has either always existed, or it is composed of entities that have.

FE_DirUnmeas: FE(M) is an existence, or is composed of existences, that have a property that is not directly measurable by current standards.

1. By the Constraint Law, an entity must first exist before it can be constrained. FE(M) is constrained to deform under the presence of mass and energy to produce the effects of gravitational lensing, gravitational time dilation etc. Thus:

$$[Constraint\ Law] \wedge Deform(FE) \rightarrow Exists(FE)$$

2. $FE(M)$ exists, yet we can only measure it indirectly through gravitational waves, gravitational lensing, and even quantum processes, etc.

$$1. \wedge [Can't\ directly\ measure\ FE(M)] \rightarrow FE\_DirUnmeas$$

3. The existence of FE(M) implies that it is an element in the set of everything that exists. Thus:

$$1. \rightarrow FE(M) \in \xi$$

4. By the Law of Spatial Existence, and the Isomorphism Theorem of Space:

FE(M) exists in Space and Space is isomorphic to $\mathbb{R}^n$ for some $n \geq 3$

5. By the Law of Ontological Continuity, FE(M) has either always existed, or it is composed of entities that have. Thus:

$$1. \wedge [Law\ of\ Ontological\ Continuity] \rightarrow FE\_AE$$

Thus, it is established that FE(M) is a set of entities that exist in infinite space. Furthermore, these entities are not directly measurable. Since this is not compatible with spacetime, it follows that spacetime does not exist. Notice that thus far, the only physics necessary to establish the theorems and logic of this framework is that which is necessary for determining that $Exists(FE)$: namely gravitational waves, or gravitational lensing ironically predicted by GTR. By additionally incorporating experimental results from QM, further improvements to the theory can be made as follows.

In the vacuum of space, before the emergence of any virtual particles, the only existence is the existence of a subset of FE(M) that we cannot directly measure. By the Existence Law, it follows that any virtual particles that emerge in the vacuum of space must therefore be formed/created out of FE(M) itself. That is, virtual particles must be produced from the only existence that exists in the vacuum of space: namely FE(M). The only way this is possible is if the components of FE(M) that form a particle, have individual properties that are not directly measurable, but when combined their properties superimpose so as to produce a measurable property. Thus:

VPE: Virtual particles emerge in the vacuum of space.

OEIV: The only existence in the vacuum of space, prior to the emergence of the virtual particles, is that which composes FE(M).

QP: The quantum process of virtual particle pair production and annihilation models an exchange in which existences composing FE(M), superimpose to produce measurable particles and vice versa.

$$OEIV \wedge VPE \wedge [Existence\ Law] \rightarrow QP$$

FE_MP: FE(M) is composed of multiple existences (think of a uniform lattice), with a variety of unmeasurable properties. When combinations of such existences interact, their properties superimpose, sometimes producing a net property that we can measure, thus forming what we call a particle.

$$QP \rightarrow FE\_MP$$

FP_NF: The particles of the standard model are not fundamental.

$$FE\_MP \wedge QP \rightarrow FP\_NF$$

QuantAndMult_Lattice: The multiple existences from FE_MP are discrete and quantized forming a uniform lattice-like structure. Thus FE(M) is lattice-like.

$$FE\_MP \wedge [QM\ is\ quantized] \rightarrow QuantAndMult\_Lattice$$

ApproxZeroVol: The volume of the individual existences in QuantAndMult_Lattice cannot be zero, but they can be smaller than detectable range.

$$\Diamond(Point\ Entity\ Theorem \wedge [Existence\ Divisibility\ Theorem] \rightarrow ApproxZeroVol)$$

Since particles are formed from combinations of existences that do not individually have measurable properties, it follows that the existences composing FE(M) need not individually be bound by our physical laws. Thus there isn't a reason to assume that they are bound by the speed of light, resulting in a logical explanation as to how entanglement can occur. Thus:

FEisNotBound: The individual existences u_i composing FE(M) are not necessarily bound by our physical laws until they superimpose producing a particle that can be measured. Thus such existences should not be assumed to be bound by the speed of light, or constrained by any other known law other than those of logic.

$$Existences\ in\ FE\_MP\ are\ not\ measurable \rightarrow FEisNotBound$$

Entanglement: There is an existence that is not directly measurable, that propagates the information between some particles at a speed that is not bound by c.

$$[Information\ Law] \land [FEisNotBound] \land [Entanglement\ occurs] \rightarrow Entanglement$$

Tunneling: There is a non-zero probability that a particle dissociates into its respective existences (each a respective u_i), and can thus bypass a potential well, recombining on the exterior potentially faster than c.

$$FEisNotBound \land [Tunneling\ Occurs] \rightarrow Tunneling$$

By the Existence Law, the total existence of a particle cannot be produced from non existence, and thus a particle cannot exist in multiple states at once. According to this model, two forms of superposition are allowed:

ExistencesInteract: The individual existences u_i composing a particle can dissociate and their individual states $S(\chi)$ superimpose.

WavesPropFE: The particle produces a series of waves that propagate through FE(M) and those waves give the illusion of the particle being in a superposition of states.

WaveParticleDuality: The existences making up a particle can collectively act as both a wave and a particle.

$$([Existence\ Law] \land [Superposition]) \rightarrow (ExistencesInteract \lor WavesPropFE)$$

However, if WavesPropFE is true, then there isn't any means for there to be a distinction between when a particle is observed and when it is not. However, if ExistencesInteract is true, then the particle can dissociate when not observed, and remain as a particle when observed. Thus:

$$ExistencesInteract \rightarrow WaveParticleDuality$$

It is thus also established that this framework is compatible with observations in QM: namely quantum tunneling, superposition, entanglement, and wave-particle duality. With that said, in reality, everything follows classical logic, but with a lack of knowledge about the state function $S_z(\chi)$, uncertainty emerges.

6. THE FIELD ETHER (FE) - A THEORY BASED ON THE ABOVE FRAMEWORK AND STRUCTURE

The FE theory is established based on the aforementioned framework and structure such that it acts as a set of generalized equations used to predict the results of GTR within 3-space in a manner that is consistent with observations pertaining to QM. Since this theory was produced using the framework, there aren't any paradoxes.

6.1 General concepts

QuantAndMult_Lattice posits that the universe is structured as a lattice of quantized entities, while FE_MP suggests that these existences possess properties that are not directly measurable individually. However, when they are superimposed, their combined properties can manifest as measurable particles. Therefore, loosely define the Field Ether (FE) as the lattice that pervades the universe, consisting of the particles described by QuantAndMult_Lattice and FE_MP. Every existence Z_i within the universe exists within the FE, and transitions through its own causal loop $S_Z(\chi)$, thereby replacing the concept of time as a dimension. Interactions $\tilde{I}(Z_i, FE)$ regulate the causal loop giving the illusion that everything in the universe is passing through time uniformly. It should be clarified that, according to the Missing Geometry Theorem, objects such as stars and planets do not exist as distinct entities: what exists are the individual existences that constitute these objects.

It is thus necessary to establish that the FE is able to produce the observations attributed to GTR such as black holes, time dilation, and gravitational lensing. Define an existence density **ϱ**, of the existences making up the FE per unit volume. It is also necessary to define a weak interaction $\tilde{I}(\gamma, FE)$ between the FE, and a photon that is traversing through it ($\tilde{I}(\gamma, FE)$ will be discussed in another section in more detail). Said interaction must be weak so that over small distances the total interaction is not detectable thus resulting in the speed of light being the same in all directions (within detectible means), yet over vast distances these interactions result in gravitational lensing/redshifting.

With that said, as speed increases through the FE, the number of interactions $\tilde{I}(\gamma, FE)$ also increases. Thus, increasing speed through the FE, is similar to being stationary in a region of the FE that has a higher **ϱ**. Therefore, in order for Lorentz time dilation to be compatible with that of gravitational time dilation:

The presence of mass and energy increases **ϱ**, *and velocity increases* $\tilde{I}(\gamma, FE)$

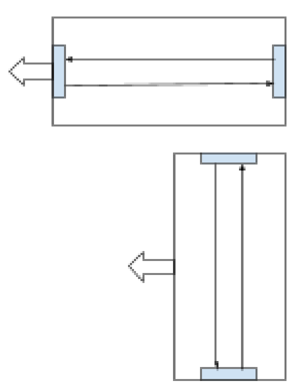


Fig 3 represents a modification to the Michelson-Morley experiment in which two distinct light clocks are positioned perpendicular to each other, and moved through space in the direction of the arrows.

In **Fig 3**, two light clocks are oriented perpendicular to each other similar to the apparatus used in the Michelson-Morley Experiment. Due to $\tilde{I}(\gamma,\ FE)$ being weak, the photons move at the speed of light c in both directions as if the FE were not present. Now suppose that each light clock is increased in length to vast distances, say that between the earth and the sun. The weak interactions $\tilde{I}(\gamma,\ FE)$ would then add up to be sufficient to show that the speed of light is not perfectly invariant. It follows that the concept of time, as measured by the light clocks, becomes more and more distorted the larger the apparatus becomes due to a difference in reading between the vertical and the horizontal clocks. Notice that this isn't a paradox or a contradiction since time doesn't exist. This is just a measurement problem.

With that said, it is necessary to establish a light clock K positioned at a point in the FE that has the smallest existence density **ϱ**, and interactions $\tilde{I}(\gamma,\ FE)$. It follows that K measures time to be equal to or faster than any other point within the FE, therefore acting as an upper limit for the rate at which time can be measured. It should be noted that when the time in another location of the FE is compared to K, it is not implied that a measurement is possible, but rather it is being established that in reality there is a relationship with or without a measurement being feasible.

When a photon is produced near K from the components of the FE in accordance with FE_MP, the net property necessarily includes the photon moving in the direction of emission. That is, the state function $S_\gamma(\chi)$ of the photon results in its motion. Time is then measured, based on the distance the light travels inside of the light clock. As the number of interactions $\tilde{I}(\gamma,\ FE)$ increases, the slower the local speed of light relative to K, and thus time dilation occurs. However, since time is based on the distance that light travels, all reference frames measure the speed of light to be the same. That is, using a light clock to measure the speed of light implies that such measurement will produce the same results in all reference frames. Therefore:

The speed of light is not constant universally (relative to k)
but in each reference frame it is measured to be c.

Time is a function of the distance light travels.

Since **ϱ** increases in the presence of mass and energy, the number of interactions $\tilde{I}(\gamma,\ FE)$ increases near massive objects resulting in a slower speed of light relative to K. However, as stated above, such a reference frame still measures the same value for c. Likewise, when speed through the FE increases, the same result occurs. Thus this model is compatible with both gravitational and Lorentz time dilation, and the invariance in the *measurement* of the speed of light (over small distances).

Since the speed of light decreases near a massive object, two things are implied: there can exist a point in which the speed of light becomes zero accounting for the concept of black holes; and the FE has a varying index of refraction accounting for the concept of gravitational lensing.

By FEisNotBound, the FE is not bound by our physical laws, and thus it is not limited by the speed of light. Thus the FE can drive the expansion of the universe faster than c in accordance with Hubble's Law.

Since the FE exists, it is conceivable that waves can propagate through it and in doing so, they alter the interactions $\tilde{I}(\gamma,\ FE)$ locally producing a detectable shift in the interferometer at LIGO [6].

6.2 Advanced concepts

By the Isomorphism Theorem of Space, space is isomorphic to the vector space $\mathbb{R}^n$, for some $n \geq 3$. Thus, define a Euclidean Coordinate System in otherwise empty space, and define a geometry S in relation to it such that:

$$S = \{(x, y, z) | x^2 + y^2 + z^2 \leq R^2,\ R \in \mathbb{R}\}$$

$$U \subseteq \xi \mid \forall\, u_i \in U,\ P(u_i)\ is\ directly\ undetectable\ and\ u_i\ is\ quantized$$

$$FE = \{u_i | u_i \subseteq U,\ u_i \exists \in S,\ U\ is\ uniformly\ distributed\} \quad \text{(Definition of the FE)}$$

According to FEisNotBound, dR/dt (the rate of change of the universe's radius) is not restricted by the speed of light, nor are the individual existences u_i, which allows for the universe's expansion in line with Hubble's Law. Based on FE_MP, the individual existences u_i are not directly measurable, but their properties can combine to form a net measurable property, resulting in the formation of particles. These existences u_i transition through their causal loop $S_{ui}(\chi)$, leading to random interactions $\tilde{I}(u_i,\ FE)$. Occasionally, these interactions lead to the formation of virtual particle pairs. As discussed earlier, quantum mechanics describes these processes where particles emerge from and annihilate back into the FE.

The Michelson-Morley Experiment (MME) is perhaps the most notoriously referenced scientific measurement establishing the speed of light to be constant. However, there is a slight nuance that needs to be clarified. That is, according to the MME, and several modern day versions, the speed of light c is invariant at least within detectable ranges. This does not imply that it is perfectly invariant.

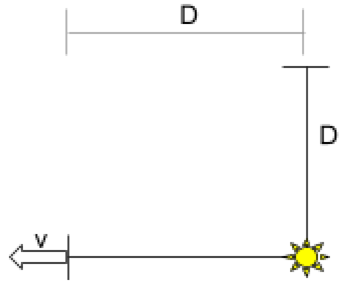


Fig 4 illustrates the Michelson-Morley Experiment (MME) apparatus moving through empty space.

With that said, suppose that the MME apparatus is placed in otherwise empty space as depicted in **Fig 4**. Since nothing else exists, by the contrapositive of the Constraint Law, nothing exists to interact with the photons. Additionally, there isn't any reference frame to establish the velocity v. Hence, the velocity of the photons relative to the apparatus is always c in all directions. That is, the equations of motion for the photons in both directions of each arm is just $D = ct$. This is consistent with foundational principles of GTR in which the speed of light is invariant.

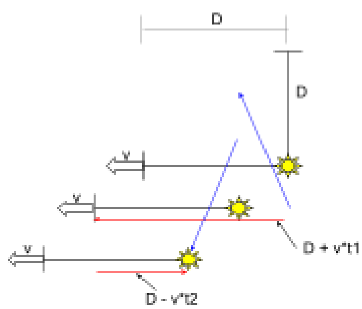


Fig 5 illustrates the Michelson-Morley Experiment (MME) apparatus moving to the left through a Medium. The three stages depicted correspond to photon emission, photon reflection, and photon return. The total path length traveled by each photon is shown in red and blue, respectively.

Now suppose that, like the sound wave, a photon needed a medium to propagate as shown in **Fig 5**. As the apparatus moves through such medium at velocity v, the equation of motion for the first horizontal photon is:

$$D_{\leftarrow} = (c - v)t_1$$

Therefore, if the photon doesn't require a medium the equation of motion is $D = ct$, and if it does require a medium the equation is $D_{\leftarrow} = (c - v)t_1$. It follows that if the photon doesn't need a medium, but instead has a weak interaction $\tilde{I}(\gamma,\ FE)$ as it propagates, then the equation of motion must be $D_{\leftarrow} = (c - \alpha v)t_1$, where $|\alpha| << 1$ establishes that the interaction is weak.

That is, αv just changes the speed of light slightly. The equations are as follows for some $\alpha_h = \alpha_h(v)$ and $\alpha_v = \alpha_v(v)$:

$D = (c - \alpha_h v)t_1 = (c + \alpha_h v)t_2$ (Time components)

$\Rightarrow t_1 = D/(c - \alpha_h v)$ and $t_2 = D/(c + \alpha_h v)$

$$\Rightarrow T = t_1 + t_2$$
$$= 2Dc/(c^2 - \alpha_h^2 v^2) \quad \text{(Total time (horizontal photon), 1)}$$

So the total distance traveled by the horizontal photon is:

$$D_h = (D + \alpha_h v t_1) + (D - \alpha_h v t_2)$$
$$= 2D + \alpha_h v(t_1 - t_2)$$
$$= 2D + \alpha_h v(D/(c - \alpha_h v) - D/(c + \alpha_h v))$$
$$= 2D + \alpha_h v D(\,(c + \alpha_h v) - (c - \alpha_h v)\,)/(\,(c - \alpha_h v)(c + \alpha_h v)\,)$$
$$= 2D + 2\alpha_h^2 v^2 D/(c^2 - \alpha_h^2 v^2)$$
$$= (2Dc^2 - 2D\alpha_h^2 v^2 + 2D\alpha_h^2 v^2)/(c^2 - \alpha_h^2 v^2)$$
$$= 2Dc^2/(c^2 - \alpha_h^2 v^2) \quad (2)$$

And the total distance traveled by the vertical photon (blue) is:

$$D_v = 2\,[\,D^2 + (\alpha_v vT/2)^2]^{1/2}$$
$$= 2\,[\,D^2 + (\alpha_v vDc/(c^2 - \alpha_h^2 v^2))^2]^{1/2}$$
$$= 2[D^2(c^4 - 2c^2\alpha_h^2 v^2 + \alpha_h^4 v^4) + \alpha_v^2 v^2 D^2 c^2]^{1/2}/(c^2 - \alpha_h^2 v^2)$$
$$= 2D[(c^4 - c^2 v^2(2\alpha_h^2 - \alpha_v^2) + \alpha_h^4 v^4)]^{1/2}/(c^2 - \alpha_h^2 v^2)$$
$$= (\,2Dc^2/(c^2 - \alpha_h^2 v^2)\,)[1 - v^2(2\alpha_h^2 - \alpha_v^2)/c^2 + \alpha_h^4 v^4/c^4]^{1/2}$$
$$= D_h[1 - v^2(2\alpha_h^2 - \alpha_v^2)/c^2 + \alpha_h^4 v^4/c^4]^{1/2} \quad (3)$$

Notice that $\lim_{\alpha_h \to 0} D_h = \lim_{(\alpha_h, \alpha_v) \to (0,0)} D_v = 2D$, so the weaker the interaction Ĩ$(\gamma,\ FE)$, the closer the result gets to that of GTR. Also notice that if D is made large enough, then for $\alpha \neq 0$, and $v \neq 0$, the error becomes measurable. Thus, the speed of light is very close to being invariant over small distances, but over vast distances, such as those between earth and the sun, its variance will become apparent.

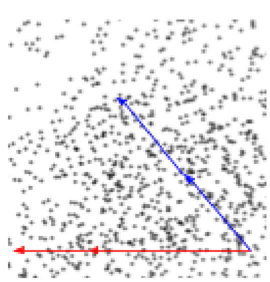


Fig 6 is a diagram that represents the total path length of each photon respectively through the FE.

Assuming a uniform density $\boldsymbol{\varrho}$ as shown in **Fig 6**, the number of interactions $\tilde{I}(\gamma, CE)$ is proportional to the path length traversed by each photon, not the length of each arm. With that said, the total time of travel for each photon is not T above, but rather:

$$\boldsymbol{T}_h = D_h/c + nt_{int} = 2D/c_h \quad \text{(horizontal photon, 4)}$$
$$\boldsymbol{T}_v = D_v/c + nt_{int} = 2D/c_v \quad \text{(vertical photon, 5)}$$

where (n) is the number of interactions $\tilde{I}(\gamma, FE)$, t_{int} is the time each interaction takes to occur, 2D is the distance traveled by the photon relative to the clocks reference frame, and c_h and c_v are the speed of light in the horizontal and vertical directions respectively, relative to K. Solving equation 4 for c_h yields:

$$D_h/c + nt_{int} = 2D/c_h$$
$$c_h(D_h + nt_{int}c) = 2Dc$$
$$c_h = 2Dc/(D_h + [n]t_{int}c)$$
$$c_h = 2Dc/(D_h + [\boldsymbol{\varrho} D_h]t_{int}c)$$
$$c_h = 2Dc/[D_h(1 + [\boldsymbol{\varrho}]t_{int}c)]$$
$$c_h = 2Dc/[\{2Dc^2/(c^2 - \alpha_h^2 v^2)\}(1 + [\boldsymbol{\varrho}]t_{int}c)]$$
$$c_h = \frac{c(1-\alpha_h^2 v^2/c^2)}{(1+[\boldsymbol{\varrho}]t_{int}c)} \quad \text{(Horizontal Light Dilation, 6)}$$

Likewise, solving equation 5 for c_v yields:

$$D_v/c + nt_{int} = 2D/c_v$$
$$c_v(D_v + nt_{int}c) = 2Dc$$
$$c_v = 2Dc/(D_v + [n]t_{int}c)$$
$$c_v = 2Dc/(D_v + [\boldsymbol{\varrho} D_v]t_{int}c)$$
$$c_v = 2Dc/[D_v(1 + [\boldsymbol{\varrho}]t_{int}c)]$$
$$c_v = 2Dc/[\{D_h[1 - v^2(2\alpha_h^2 - \alpha_v^2)/c^2 + \alpha_h^4 v^4/c^4]^{1/2}\}(1 + [\boldsymbol{\varrho}]t_{int}c)]$$
$$c_v = 2Dc(c^2 - \alpha_h^2 v^2)/[\{2Dc^2[1 - v^2(2\alpha_h^2 - \alpha_v^2)/c^2 + \alpha_h^4 v^4/c^4]^{1/2}\}(1 + [\boldsymbol{\varrho}]t_{int}c)]$$
$$c_v = c_h/[1 - v^2(2\alpha_h^2 - \alpha_v^2)/c^2 + \alpha_h^4 v^4/c^4]^{1/2} \quad \text{(Vertical Light Dilation, 7)}$$

From equations 4 and 5:

$$c_v T_v = c_h T_h$$

$$\begin{aligned} T_v &= c_h T_h / c_v \\ &= T_h [1 - v^2(2\alpha_h^2 - \alpha_v^2)/c^2 + \alpha_h^4 v^4/c^4]^{1/2} \quad (8) \end{aligned}$$

Equations for D_h, D_v, c_h, c_v, T_h, and T_v have therefore been established, but it is also necessary to derive equations for α_h, α_v, and ϱ. To do this, let's go back to the MME apparatus moving through otherwise empty space. Each photon travels through its causal loop $S_\gamma(\chi)$ at speed c relative to the apparatus.

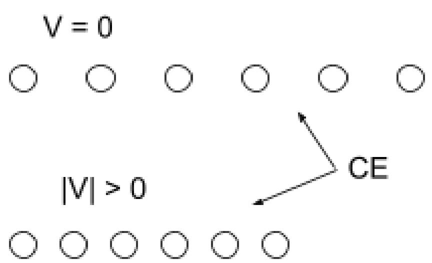


Fig 7 illustrates the existences of the FE as perceived by a photon. At the top, the MME apparatus is stationary relative to the FE resulting in an emitted photon perceiving the FE as spread out. As the velocity of the apparatus increases, the FE appears bunched up resulting in a change of α.

If the FE is now introduced, the photon is still emitted at speed c, but the interactions $\tilde{I}(\gamma,\ FE)$ change the average speed. As shown at the top of **Fig 7**, when the velocity of the MME apparatus is zero through the FE, from the photons perspective the existences making up the FE are spread out maximally. As the apparatus increases in speed relative to the FE, from the photons perspective, the existences making up the FE appear bunched as shown at the bottom of **Fig 7**. Hence why $\alpha = \alpha(v)$.

We shall now derive the equations for α_h and α_v in which $\varrho = 0$ (corresponding to no other mass present). As claimed above, time is a function of the distance that light travels through its causal loop. Therefore, in order for this theory to produce the results of Lorentz time dilation, the speed of light (relative to K) must dilate similar to how time dilates in special relativity.

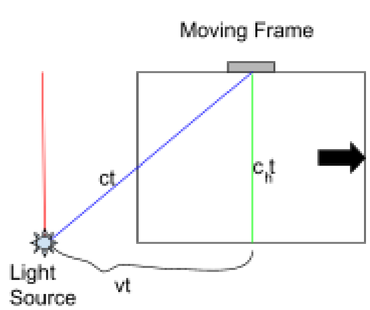


Fig 8.

Consider a light source that is stationary relative to the FE as shown in **Fig 8**. At the moment a moving reference frame reaches the light source, a flash occurs (same setup as that in special relativity). Since time doesn't exist, by the contrapositive of the Constraint Law, it cannot dilate and thus c_h dilates instead. Thus:

$$c_h^2 + v^2 = c^2$$

$$c_h^2 = c^2 - v^2$$

$$c_h = c\sqrt{1 - (v/c)^2} \quad (9)$$

Comparing this result to equation 6 (with $\varrho = 0$) yields:

$$c\sqrt{1 - (v/c)^2} = c(1 - \alpha^2 v^2/c^2)$$

$$\alpha_h^2 v^2/c^2 = (1 - \sqrt{1 - (v/c)^2})$$

$$\alpha_h(v) = [(1 - \sqrt{1 - (v/c)^2})c^2/v^2]^{1/2} \quad (|v| << c, 10)$$

With that said, notice that equations 3, 7, and 8 have the same coefficient function of $[1 - v^2(2\alpha_h^2 - \alpha_v^2)/c^2 + \alpha_h^4 v^4/c^4]^{1/2}$. That is, if $1 - v^2(2\alpha_h^2 - \alpha_v^2)/c^2 + \alpha_h^4 v^4/c^4 = 1$ then $D_v = D_h$, $T_v = T_h$, and $c_v = c_h$ meaning that both the horizontal and vertical photons travel the same distance in the same time, resulting in them staying in phase. This is only possible because the weak interaction $\tilde{I}(\gamma,\ FE)$ causes the vertical photons path to curve such that $D_v = D_h$, and this curve is modeled herein as a delay. That is, rather than having to model the curve of the vertical photon's path due to the interactions $\tilde{I}(\gamma,\ FE)$, its path is modeled as straight with a time delay at each interaction. Equations 2 and 3 ensure that the path lengths and time are the same in a constant density $\varrho = 0$, and equation 7 ensures that this remains true with gravitational effects accounted for ($\varrho \neq 0$). Thus:

$$1 - v^2(2\alpha_h^2 - \alpha_v^2)/c^2 + \alpha_h^4 v^4/c^4 = 1$$

$$-(2\alpha_h^2 - \alpha_v^2)c^2 + \alpha_h^4 v^2 = 0$$

$$\alpha_v^2 c^2 = 2\alpha_h^2 c^2 - \alpha_h^4 v^2$$

$$\alpha_v^2 c^2 = (2c^2 - \alpha_h^2 v^2)\alpha_h^2$$

$$\alpha_v^2 c^2 = (2c^2 - [(1 - \sqrt{1 - (v/c)^2})c^2/v^2]v^2)[(1 - \sqrt{1 - (v/c)^2})c^2/v^2]$$

$$\alpha_v^2 c^2 = c^2(2 - (1 - \sqrt{1 - (v/c)^2}))[(1 - \sqrt{1 - (v/c)^2})c^2/v^2]$$

$$\alpha_v^2 = (1 + \sqrt{1 - (v/c)^2})[(1 - \sqrt{1 - (v/c)^2})c^2/v^2]$$
$$\alpha_v^2 = (1 - (1 - (v/c)^2))c^2/v^2$$
$$\alpha_v^2 = (v/c)^2c^2/v^2$$
$$\alpha_v = 1 \quad (11)$$

Equations 2-7 are simplified below with the appropriate substitutions for α_v and α_h:

$$D_h = D_v = 2D/\sqrt{1 - (v/c)^2} \quad (12)$$

$$T_h = T_v = 2D(1 + [\varrho]t_{int}c)/[c\sqrt{1 - (v/c)^2}] \quad (13)$$

$$c_h = c_v = c\sqrt{1 - (v/c)^2}/(1 + [\varrho]t_{int}c) \quad \text{(Light and Time dilation, 14)}$$

It should be specified that c_h and c_v are the average speeds of light in the horizontal and vertical directions respectively, not the speed of light along the curved paths. Thus it is not necessarily true that $D_h = T_h c_h$ as shown in equation 4. Thus, equations 12-14, with $\varrho = 0$, will produce the exact same results as the MME, with the exact same time dilation of special relativity, all within 3-space. By producing an equation for ϱ, gravitational effects can also be incorporated. Now, it should be clarified that nothing states that the speed of light is perfectly invariant since $|Err(c)| > 0$, but in order to satisfy those that require the laws of physics be invariant, this assumption is made.

Notice that there isn't a need for length contraction in this scenario, even though equation 12 may resemble the length contraction equation from special relativity. To clarify, imagine a muon emerging at the Earth's horizon and traveling at relativistic speeds toward the surface. Normally, one would argue that in the muon's reference frame, time dilates and length contracts. However, in this model, the speed of light in the muon's reference frame dilates along with all fundamental forces as explained earlier. This slowing down of the fundamental forces leads to a longer decay process. Length contraction is unnecessary because there is no violation if the muon perceives itself as moving faster than the speed of light (c) due to its slower clock. As long as the muon's speed, relative to clock K, does not exceed c, it can perceive its own speed as infinite without any known violations. Therefore, length contraction is not required (but is still possible within the FE if desired). One might argue that a moving charge generates a force due to length contraction, but that is not the case herein. The force carriers of the moving charges experience are slowed down producing the effect attributed to length contraction.

Now consider an existence Z placed in the FE. By the 3-D entity theorem Z must therefore occupy some volume $V > 0$. We can therefore say that the amount of information (I) that Z has is proportional to its volume such that $I = kV$ for some $k \in \mathbb{R}$. Now, just as a magnet placed near a ferromagnetic material aligns the dipoles of the material producing a stronger field, the information that Z contains aligns the properties of the existences composing the FE to produce what we call fields. That is, the information that Z has gets spread out over the FE, and therefore any secondary existence placed in that field obtains information about Z. It follows that fields do not produce particles contrary to Quantum Field Theory, but instead the information an existence Z (such as a particle) has gets distributed over the FE producing field(s) in the FE.

With that said, wrap Z in a spherical shell of area $4\pi r^2$, and weigh the distribution of the information from Z at each radii as $W(r)$. It therefore follows that:

$$kV = 4\pi \int_{\mathbf{a}>0}^{\infty} W(r) \cdot r^2 dr \quad \text{(Information Distribution Law, 15)}$$

Now, if we restrict $W(r)$ to the form A/r^q, in order for equation 15 to converge, $q > 3$ for some $q \in \mathbb{R}$. Thus:

$$kV = 4\pi A \int_{\mathbf{a}>0}^{\infty} \frac{1}{r^{q-2}} dr \quad \text{(Assuming } W(r) = A/r^q\text{, 16)}$$

It follows that the information pertaining to a field F at any distance (r) is simply the integrand in equation 16, and the total information throughout the FE due to Z is kV. Thus:

$$F = \frac{4\pi A}{r^{q-2}} \quad \text{(Field equation when } W(r) = A/r^q\text{, 17)}$$

Notice that for $A = Gm_1/(4\pi)$, and $q = 4$, equation 17 reduces to Newton's gravitational field. In general, all fields in physics are represented as:

$$F = 4\pi W(r) r^2 \quad \text{(All fields, 18)}$$

Now suppose that there is a massive object O placed within the FE. By equation 15, the information that O has is distributed over the existences making up the FE producing a field described in equation 18. When a photon then propagates over that field, it obtains information about O that is proportional to the field strength at that point. It follows that:

$$\varrho = 4\pi W(r) r^2 \quad (19)$$

By QuantAndMult_Lattice, the FE is a quantized lattice. This means that all of the subatomic particles making up objects such as stars and planets can exist between the elements of the FE, rather than occupying their same spatial coordinates. That is, subatomic particles can "fill the gap" between the existences composing the FE eliminating the need for the possibility of the Non-Biconditional Constraint Law. Now it should be clarified that by the 3-D Entity Theorem, an existence Z has a non-zero volume and thus it is impossible for singularities to exist. Since the Non-Biconditional Constraint Law is not necessary in this model, and singularities cannot exist, it is reasonable to assume that existences (at least within our universe) cannot occupy the same spatial coordinates. Thus, everything that exists in our universe has a type of boundary, and you can compress these existences together, but you can't ever reduce the total volume of existence. Eventually, after compressing enough existences together, the influence that the object has on the FE prevents light from escaping nearby. If we therefore confine a black hole to a spherical shape, the amount of information is $I = kV = 4\pi k r_{EH}^3/3$ where r_{EH} is the radius of the event horizon. It follow that:

$$r_{EH} = [3I/(4\pi k)]^{1/3} \quad \text{(Radius of a spherical black hole, 20)}$$

Thus, information is never lost resolving the Black Hole Information Paradox, and singularities do not exist resolving the Singularity Problem. As a speculation, by FEisNotBound it is possible that the FE is not subject to gravity itself, and thus as a black hole forms, it pushes the FE out of the way: by QP, this would imply that quantum processes do not occur inside of a black hole. Without quantum processes occuring inside of a black hole, the following proposed model of quantum gravity would produce a force of zero inside the event horizon, while still contributing information that produces the gravitational field in the FE. In this case, an existence Z inside of the event horizon would not feel any substantial force, but would still contribute to the gravitational pull of the black hole.

With the index of refraction (n) defined as $c = nc_0$, using equation 6, $c = n\frac{c\sqrt{1-(v/c)^2}}{(1+[\mathbf{e}]t_{int}c)}$.

Thus:

$$n = \frac{(1+[\mathbf{e}]t_{int}c)}{\sqrt{1-(v/c)^2}} \quad \text{(Index of refraction of the FE, 21)}$$

Using Fermat's Principle, the action $S = \int_a^b n\sqrt{r^2 + (r')^2}\,d\theta$ where $r = r(\theta)$ is the path that light takes when modeled in polar coordinates. Assuming that $n = n(r, v)$, the integrand is not explicitly dependent on θ, thus we can use the Beltrami Identity resulting in:

$$n\sqrt{r^2 + (r')^2} - r'\frac{\partial}{\partial r'}(n\sqrt{r^2 + (r')^2}) = const$$

$$n\sqrt{r^2 + (r')^2} - r'(nr'/\sqrt{r^2 + (r')^2}) = const$$

$$nr^2 + n(r')^2 - n(r')^2 = const\sqrt{r^2 + (r')^2}$$

$$nr^2 = const\sqrt{r^2 + (r')^2}$$

$$n^2r^4 = const^2r^2 + const^2(r')^2$$

$$\sqrt{n^2r^4 - const^2r^2}/|const| = \frac{dr}{d\theta}$$

$$\theta = \int_a^b \frac{|const|dr}{\sqrt{n^2r^4 - const^2r^2}} + B \quad \text{(Gravitational Lensing, 22)}$$

6.3 FE and GTR comparison

In GTR the metric equation is $cdt_0 = \sqrt{g_{\mu\nu}dx^{\mu}dx^{\nu}}$. As explained above, the speed of light herein dilates like time in GTR, and therefore $c_h dt = c\, dt_0$. It follows that:

$$c_h dt = \sqrt{g_{\mu\nu}dx^{\mu}dx^{\nu}} \quad \text{(GTR analog)}$$

To explain this, in GTR there is a dimension of time that dilates. In this proposed theory, a photon transitions through its own causal loop $S_{\gamma}(\chi)$ and the interactions $\tilde{I}(\gamma,\ FE)$ slow it down resulting in what we perceive as time dilation. As claimed herein, we measure time based on the distance that light travels, and the interactions that cause light to slow down also cause the other fundamental forces to slow down, resulting in even atomic clocks undergoing time dilation. In the GTR analog, the time component is in relation to the parameter χ which is not a universal dimension and does not exist. By slowing down the speed of light (relative to χ), the illusion of time dilation occurs. By dividing the GTR analog by dt yields:

$$c_h = \sqrt{g_{\mu\nu}\frac{dx^{\mu}}{dt}\frac{dx^{\nu}}{dt}} \quad \text{(GTR analog)}$$

Using the Schwartzchild metric in the GTR analog without rotational velocities yields:

$$c_h = \sqrt{\frac{r-r_s}{r}c^2 - \frac{r}{r-r_s}\left(\frac{dr}{dt}\right)^2} \quad \text{(GTR-SM analog)}$$

If we set $\frac{dr}{dt} = 0$, $c_h = \sqrt{\frac{r-r_s}{r}}c$ meaning that the speed of light slows down in a gravitational field, and this results in time also slowing down. Compare this to the gravitational time dilation of GTR-SM: $dt_0 = \sqrt{\frac{r-r_s}{r}}dt$.

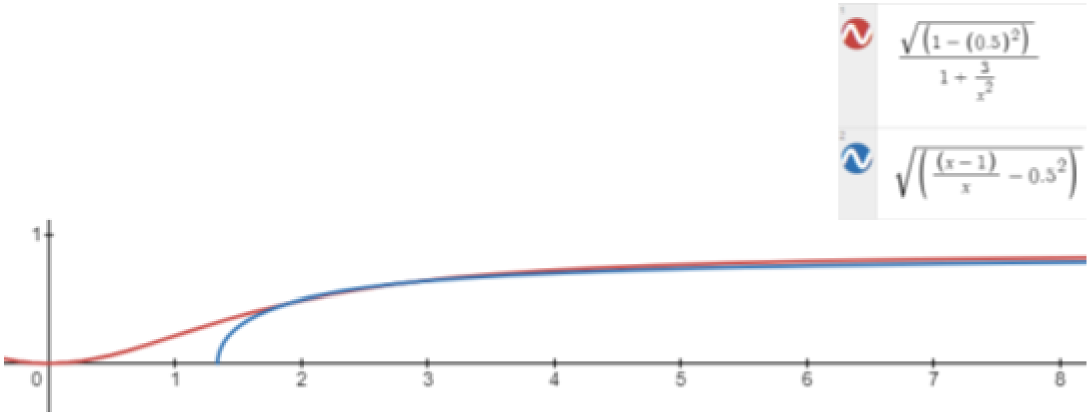


Fig 9 shows a comparison between equation 23 and the GTR-SM analog.

We are now ready to compare the FE theory to the GTR analog. Using $3/r^2$ as an approximation (described above), $\varrho = 3/r^2$. Equation 6 becomes:

$$c_h \approx c\sqrt{1 - (v/c)^2}/(1 + [3/r^2]t_{int}c) \quad (23)$$

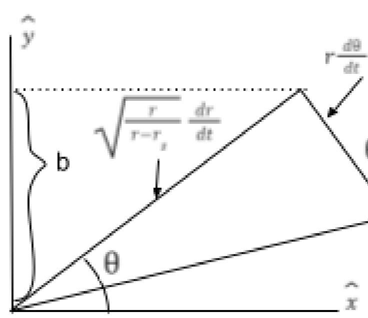
Fig 9 is a comparison between the GTR analog and equation 23 with $v = 0.5c$. Now ϱ is just being approximated: with a more precise equation for ϱ, the results of GTR can be perfectly aligned with the FE theory.

7. The Quantum Nature of Gravity

This section is intended to provide a proof of concept as to the cause of the gravitational force, based on the index of refraction of the FE described by equation 21. As illustrated above, this model very closely parallels the results of GTR and since the redshift equation of FE has not yet been derived, we shall use the Schwartzchild metric.

7.1 The gravitational redshift equation

Fig 10 shows how the components of the Schwarzschild Metric fit geometrically for a photon initially traveling tangentially to the related mass.



For a photon traveling in a plane in which φ = 0, the Schwartzchild metric [7] yields the following equation:

$$\frac{r-r_s}{r}c^2 - \frac{r}{r-r_s}\left(\frac{dr}{dt}\right)^2 - r^2\left(\frac{d\theta}{dt}\right)^2 = 0 \quad (24)$$

Where $r_s = \frac{2GM}{c^2}$ is the Schwartzchild radius. Adding up the components from **Fig 10** in the $\hat{x}$ and $\hat{y}$ directions yields:

$$< \frac{\partial x}{\partial t} = \sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}cos(\theta) - r\frac{d\theta}{dt}sin(\theta), \frac{\partial y}{\partial t} = \sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}sin(\theta) + r\frac{d\theta}{dt}cos(\theta) > \quad (25)$$

Dividing the x-component of equation 25 by ∂x, squaring both sides, and multiplying by $\partial^2 E$ yields:

$$\left[\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}cos(\theta) - r\frac{d\theta}{dt}sin(\theta)\right]^2 \frac{\partial^2 E}{\partial x^2} = \frac{\partial^2 E}{\partial t^2} \quad (26)$$

Since the $\hat{x}$ direction corresponds to $\theta = 0$, equation 26 reduces to:

$$\left[\sqrt{\frac{r}{r-r_s}}\frac{dr}{dt}\right]^2 \frac{\partial^2 E}{\partial r^2} = \frac{\partial^2 E}{\partial t^2} \quad (27)$$

Notice the similarity between equation 27 and the wave equation $c^2\frac{\partial^2 E}{\partial x^2} = \frac{\partial^2 E}{\partial t^2}$. From equation 24, $\frac{r}{r-r_s}\left(\frac{dr}{dt}\right)^2 = \frac{r-r_s}{r}c^2$, and thus equation 27 can be written as:

$$\frac{r-r_s}{r}c^2\frac{\partial^2 E}{\partial r^2} = \frac{\partial^2 E}{\partial t^2} \quad (28)$$

Setting E = R(r)**T**(t) in equation 28, and solving for R(r) yields:

$$\frac{d^2R(r)}{dr^2} = -\left[k^2\frac{r}{r-r_s}\right]R(r) \quad (29)$$

Therefore the wavelength of the photon in equation 29 is related by the equation:

$$k\sqrt{\frac{r}{r-r_s}} = \frac{2\pi}{\lambda}$$

Thus, the wavelength λ as observed at radius r is related to the wavelength λ_∞ at infinity by [8]:

$$\lambda = \frac{2\pi}{k}\sqrt{\frac{r-r_s}{r}} = \lambda_\infty\sqrt{\frac{r-r_s}{r}} \quad (30)$$

7.2 Quantum Gravity

In a relatively stationary reference frame: The momentum p of a photon is $\frac{h}{\lambda}$ [9]. Using equation 30, for k number of photons, this can be written as:

$$M(p) = \frac{hk}{\lambda_\infty\sqrt{\frac{r-r_s}{r}}}$$

$$= \frac{hk}{\lambda_\infty}\sqrt{\frac{r}{r-r_s}}$$

Therefore the measured force exerted by the photon as it is omitted from an object O is:

$$M(F) = \frac{hk}{\lambda_\infty}\frac{d}{dt}(\sqrt{\frac{r}{r-r_s}})$$

$$= \frac{hk}{2\lambda_\infty}(\frac{dr}{dt} = c)(\frac{1}{\sqrt{r(r-r_s)}} - \frac{\sqrt{r}}{(r-r_s)^{1.5}})$$

$$= \frac{hkc}{2\lambda_\infty}(\frac{r-r_s}{\sqrt{r}(r-r_s)^{1.5}} - \frac{r}{\sqrt{r}(r-r_s)^{1.5}})$$

$$= \frac{hkc}{2\lambda_\infty}(\frac{-r_s}{\sqrt{r}(r-r_s)^{1.5}})$$

Therefore:

$$M(F) = \frac{-GMhk}{c\lambda_\infty}(\frac{1}{\sqrt{r}(r-\frac{2GM}{c^2})^{1.5}}) \quad (31)$$

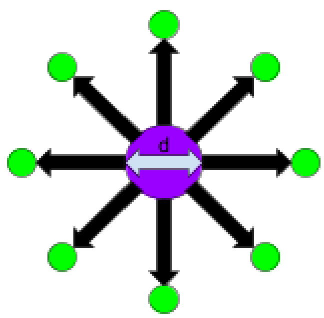
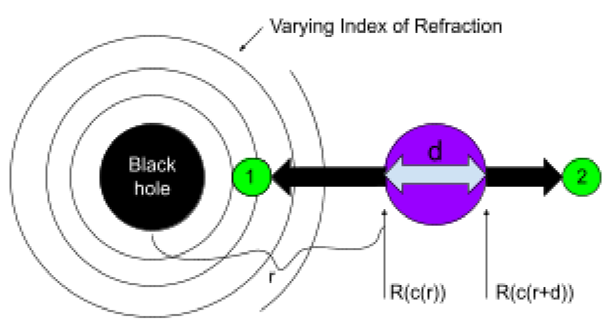


Fig 11 represents an object O (purple) of diameter d, that radiates a uniform field of virtual photons (green) in all directions. All of the photons produce the same momentum on O, uniformly resulting in a net acceleration of zero.

In **Fig 11**, the mathematical framework is illustrated in which an object O, of diameter d, radiates a uniform field of virtual photons in all directions. At this point we are not concerned about conservation laws, as we are just working with concepts. This radiation results in a net force of zero acting on O.

Fig 12 shows object O placed into a non-uniform index of refraction produced by the presence of a black hole. The momentum produced by virtual particle 1 is greater than the momentum of virtual particle 2 producing a type of repulsion.



In **Fig 12**, object O is placed into the non-uniform index of refraction expressed by equation 21. From equation 31, the measured force exerted on O due to virtual photon 1 being emitted is:

$$M(F_1) = \frac{-GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r}(r-\frac{2GM}{c^2})^{1.5}}\right)$$

And the force exerted on O due to virtual photon 2 being emitted is:

$$M(F_2) = \frac{-GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r+d}(r+d-\frac{2GM}{c^2})^{1.5}}\right)$$

The magnitude of the net force is therefore the difference:

$$\left|M(F_{net})\right| = \frac{GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r}(r-\frac{2GM}{c^2})^{1.5}} - \frac{1}{\sqrt{r+d}(r+d-\frac{2GM}{c^2})^{1.5}}\right)$$

$$= \frac{GMhk}{c\lambda_\infty}\left(\frac{1}{\sqrt{r}(r-\frac{2GM}{c^2})^{1.5}} - \frac{1}{\sqrt{r+d}(r+d-\frac{2GM}{c^2})^{1.5}}\right) \quad (32)$$

Notice that equation 32 is zero for a point particle since $d = 0$. Also notice that this force actually pushes O away from the black hole. This is resolved if the photons are emitted and absorbed internally rather than externally, and this change makes it possible for conservation laws to then be applied. That is, the photons are emitted and absorbed by the same object and thus the total existence of the object remains constant. Since the speed of light is dilated due to interactions with the FE, one could argue that the change in energy of the photons is stored in the FE, and thus it is also conserved.

This model for gravitation does not suggest a new particle, but rather it acts as a concept in which to consider known particles as producing the force of gravity within the nucleus of atoms. For the sake of clarity, equation 32 is not considered complete.

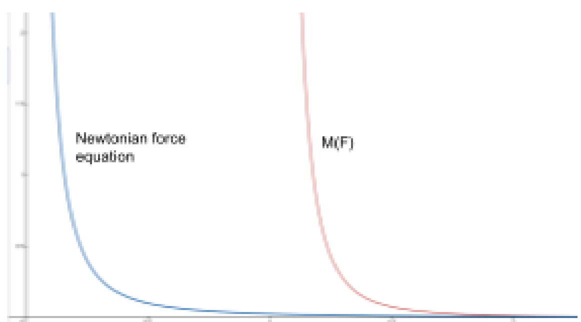


Fig 13 is a graph of the Newtonian gravitational force equation (blue) vs M(F) (red). The two functions have a very similar shape, with M(F) shifted to the right by the distance equal to the Schwartzchild radius ($r_s = 1$ unit as shown in the graph). This shows that up until close to the event horizon, the two functions model a similar force.

In **Fig 13**, $M(F_{net})$ is modeled in red, and the Newtonian gravitational force equation GMm/r^2 is modeled in blue. The two functions are very similar aside from $M(F_{net})$ being shifted to the right by the distance r_s. That is, the two equations produce an almost identical force up until about 2 Schwartzchild radii away from the blackholes center. It is important to note that at some point object O must break apart due to the extreme conditions near the event horizon. Once O breaks apart into small enough particles, d becomes approx. zero resulting in a reduced force, therefore providing a means for the gravitational force to be finite at the event horizon.

8. AUTHORS COMMENTS

Classical logic, mathematics, and physics are the most crucial tools that we have for understanding the universe, in that order. As clarified above, models such as quantum field theory, GTR, String Theory and M-Theory can all be fantastic theories with phenomenal predictive power, but the reasoning behind the prediction is inherently flawed. Thus these theories are not realistic. With that said, modern physics is plagued with such equations that model observation really well, but do not align with this framework, and thus they might give a correct value, but the description of reality that they imply is erroneous. This is why physicists make statements that do not make any sense in regards to QM: the theories tend to not align with reality. This article shows that there was never a need for physics to deviate from classical logic, nor to require more than 3 dimensions.

This theory was initiated for the sole purpose of determining if a belief in God is justified. It appears that whenever physics seems to contradict intelligent design (ID), it is only due to a fundamental flaw in its logic. As an example, when a simulation is produced it is based on equations that determine how everything in the simulation is to be displayed. While the equations of physics are descriptive not prescriptive, everything in the universe follows mathematical principles as if it were a simulation, and this is consistent with ID. A universe that doesn't have laws would perhaps be unlikely to harbor life, but it would not be consistent with an intelligent design process since it would not be possible to declare "the end from the beginning". Thus the fact that our universe is deterministic is a necessity for it to be consistent with ID. Since existence cannot be produced from non-existence, existence has always existed, and thus if it is possible for God to exist, then statistically it is guaranteed that $God \in \xi$. With that said, if it is true that God gave the universe its physical properties that cause it to evolve in such a way as to produce a desired outcome, then it follows that everything that is dependent on these laws is evidence of ID, including science. ID therefore encapsulates all of science and also allows for personal experiences rendering ID far superior to that of science. ID eliminates any complications associated with Olber's Paradox.

CONCLUSION

All of the processes of the universe such as time dilation, and superposition, are predictable from a purely logical framework in 3-space implying that in reality they all adhere to classical logic. Experimentation then determines which of the processes actually occur, and to what extent, and therefore logic coupled with experimentation produces the complete picture regarding The Laws of Existence and the Structure of Our Universe.

STATEMENTS AND DECLARATIONS

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